Status Report

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Development of a Stable Ultraviolet Source
and Techniques for Accurate Radiometry

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H. J. Kostkowski
National Bureau of Standards

High Pressure Plasma Arc As A Useful Ultraviolet Standard

The high pressure argon arc has undergone some modification in order to further improve its stability, reproducibility and pressure range. For example, the spacing between the arc constricting plates has been decreased resulting in an increase in the signal to noise ratio (factor of two) and in a higher pressure limit for stable operation (~ 25 atmospheres). Another modification has been a provision for easily removing the arc chamber windows. It was noted that a 4% decrease in transmittance of the window was occuring over an operating period of about 8-10 hours resulting in the need for more frequent cleaning.

The reproducibility of the arc spectral radiance on dismantling and reassembling has been determined to be about 3%. The day to day reproducibility without dismantling varies from about 1% for a pressure of 5 atmospheres to about 3% for a pressure of 25 atmospheres.

Measurement of the spectral radiance of the arc has been extended to higher currents and pressures. The table below gives the upper pressure limit for stable operation and the corresponding brightness temperature at 2500 A for each of the currents listed:

Current	Pressure Limit	Brightness Temp. at 2500 A
50 amp.	25 atmos.	5000 °K
75	15	5100
100	15	5400

During the last quarter the spectral radiance determination will be extended to a wavelength of 7000 A, more complete data on the temperature and electron density distribution will be obtained and a detailed paper will be prepared for publication.

Standards and Techniques For Accurate Radiometry

The main effort this quarter has been on improving the quality of the high temperature blackbody and determining the accuracy and precision of the spectroradiometer. The blackbody quality was improved by reducing the partial reflectance of the back wall of the cavity relative to the sighting hole (to ~ 0.1 steradian^{-1}) and by decreasing the temperature differences in the cavity (to ~ 10° at 2200 °C) by using more radiation shields along the length of the graphite tube. In addition, small holes placed in these shields permit the temperature of the cavity walls to be determined. The spectral radiance of the graphite blackbody at a temperature of 2200 °C is believed to deviate from an ideal blackbody by a maximum of 0.4% at 3000 A.

The present uncertainty and reproducibility of the spectroradiometer in terms of spectral radiance has been estimated and is given below:

Cause of Spectral Radiance Uncertainty	2100A	3000	6500
Blackbody Quality Uncertainty	0.4%	.25	0
Blackbody Temperature Uncertainty	.95	.65	.3
Total Spectral Radiance Uncertainty	1.35%	.9	.3
Reproducibility	.3%	.15	.05

Two days were spent at the Lewis Space Flight Center consulting with Mr. J. Pollack on problems of determining the radiance in solar simillators. The principal investigator believes the direction in which this group is now working (a diffuse reflector placed somewhere between the simillator beam and the spectrometer) will lead to accurate simillator spectral irradiance measurements. Some fundamental work on the use and calibration of diffuse reflectors is required, and this will be initiated at NBS as soon as possible.

During the last quarter, further experimental studies on the quality of the blackbody will be performed, another primary calibration will be completed, and a detailed technical paper on the spectroradiometer will be prepared.